

WHAT IS CLAIMED IS:

1. A multiple-frequency common antenna comprising:

a substrate sheet having a band gap for prohibiting propagation of an electromagnetic wave on a surface in a particular frequency band;

a first antenna for resonating in a first frequency band within the band gap provided on the surface of the substrate sheet; and

a second antenna for resonating in a second frequency band out of the band gap.

2. A multiple-frequency common antenna as in claim 1, wherein the substrate sheet comprises:

a conductor plate forming a rear surface of the substrate sheet;

a plurality of small metal plates of same shape disposed, to provide an equal interval for each end portion in two dimensions, on the surface of a dielectric material layer holding a dielectric material layer disposed on the conductor plate; and

linear metal bars for electrically coupling the conductor plate and each small metal plate in the dielectric material layer,

whereby the surface of each small metal plate arranged in two dimensions forms the surface of the substrate sheet.

3. A multiple-frequency common antenna as in claim 1, wherein the first antenna and the second antenna are coupled with

a same power feeding line at an area near a power feeding point.

4. A multiple-frequency common antenna as in claim 1,
wherein the first frequency band is in a higher frequency side
5 than the second frequency band.

5. A multiple-frequency common antenna as in claim 1,
wherein the first frequency band is in a lower frequency side than
the second frequency band.

10 6. A multiple-frequency common antenna as in claim 1,
wherein the first antenna is an inverse L-shape antenna.

15 7. A multiple-frequency common antenna as in claim 1,
wherein the first antenna is a hula-hoop type antenna including
a horizontal conductor which is parallel to the surface of the
substrate sheet.

20 8. A multiple-frequency common antenna as in claim 1,
further comprising:

a dielectric material plate disposed on the surface
of the substrate sheet,

25 wherein the first antenna is an element pattern formed
on the surface opposing to the substrate sheet of the dielectric
material plate.

9. A multiple-frequency common antenna as in claim 1,

wherein the second antenna is a monopole antenna.

10. A multiple-frequency common antenna as in claim 1,
wherein the second antenna is a helical antenna.

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11. A multiple-frequency common antenna as in claim 1,
wherein the second antenna is a non-uniform helical antenna having
a plurality of different pitches.

10 12. A multiple-frequency common antenna as in claim 1,
wherein the second antenna includes a linear conductor bar and
a helical antenna which are cascade-connected to each other.

15 13. A multiple-frequency antenna as in claim 3, wherein
the substrate sheet includes:

a first substrate sheet having the first frequency band
as a band gap; and

a second substrate sheet having a frequency band out
of the first frequency band as a band gap,

20 wherein the first substrate sheet is disposed in an
area near the power feeding point and the second substrate sheet
is disposed at an outer peripheral portion of the first substrate
sheet.

25 14. A multiple-frequency common antenna as in claim 13,
wherein the second substrate sheet has the second frequency band
as a band gap.

15. A multiple-frequency common antenna as in claim 13,
wherein a length of the linear metal bar of the first substrate
sheet is different from that of the linear metal bar of the second
substrate sheet.

16. A multiple-frequency common antenna as in claim 13,
wherein a dielectric constant of dielectric material layer of the
first substrate sheet is different from that of dielectric material
layer of the second substrate sheet.

17. A multiple-frequency common antenna as in claim 13,
wherein distance between end portions of small metal plates of
the first substrate sheet is different from that between end
portions of small metal plates of the second substrate sheet.